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Part V

Environmental Protection Agency

Benzene Emissions From Ethylbenzene/ Styrene Plants; National Emissions Standards for Hazardous Air Pollutants; Proposed Rule and Public Hearing Announcement

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 61

[AD-FRL 1551-6]

National Emissions Standards For Hazardous Air Pollutants; Benzene Emissions From Ethylbenzene/ Styrene Plants; Public Hearing

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed Rule and Notice of Public Hearing.

SUMMARY: The proposed standard would limit benzene emissions from process vents at existing and new ethylbenzene and styrene (EB/S) plants to five parts per million by volume (ppmv) on a dry basis corrected to three percent oxygen. Emissions in excess of this numerical emissions limit would be allowed only during malfunctions, startup, and shutdown. During these times, however, these emissions would have to be flared.

The proposed standard implements the Clean Air Act and is based on the Administrator's determination on June 8, 1977, that benzene presents a significant carcinogenic risk to human health as a result of emissions from one or more stationary source categories and is therefore a hazardous air pollutant (42 FR 29332). The intent of the standard is to protect the public health with an ample margin of safety.

A public hearing will be held to provide interested persons the opportunity for oral presentation of data, views, or arguments concerning the proposed standard for EB/S plants.

DATES: *Comments.* Comments must be received on or before March 7, 1981.

Public Hearing. A public hearing will be held on February 5, 1981 beginning at 9 a.m.

Request to Speak at Hearing. Persons wishing to present oral testimony must contact EPA by January 29, 1981.

ADDRESSES: *Comments.* Comments should be submitted (in duplicate if possible) to: Central Docket Section (A–130), Attention: Docket Number A–79–49, U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460.

Public Hearing. The public hearing will be held at the EPA Administration Bldg. Auditorium, Research Triangle Park, N.C. Persons wishing to present oral testimony should notify Ms. Naomi Durkee, Emissions Standards & Engineering Division (MD–13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541–5331.

Background Information Document. The Health Risk Assessment Documents for benzene and the Background Information Document (BID) for the proposed standard are contained in the docket and may be obtained from the U.S. EPA Library (MD–35), Research Triangle Park, North Carolina 27711, telephone number (919) 541–2777. Please refer to "Benzene Emissions from the Ethylbenzene/Styrene Industry—Background Information for Proposed standards," EPA–450/3–79–035a; "Assessment of Health Effects of Benzene Germane to Low Level Exposures," EPA–600/1–78–061; "Assessment of Human Exposures to Atmospheric Benzene," EPA–450/3–78–031; and "Carcinogen Assessment Group's Report on Population Risk to Ambient Benzene Exposures," EPA–450/5–80–004.

Docket. Docket No. A–79–49, containing supporting information used in developing the proposed standard, is available for public inspection between 8:00 a.m. and 4:00 p.m., Monday through Friday, at EPA's Central Docket Section, Room 2902, Waterside Mall, 401 M Street, SW., Washington, D.C. 20460.

FOR FURTHER INFORMATION CONTACT: Susan R. Wyatt, Emission Standards and Engineering Division (MD–13), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone number (919) 541–5477.

SUPPLEMENTARY INFORMATION: Notice is given that, under the authority of section 112(b)(1)(B) of the Clean Air Act (as amended), the Administrator is proposing a national emission standard for benzene emissions from ethylbenzene/styrene plants. Although the proposed EPA "Policy and Procedures for Identifying, Assessing, and Regulating Airborne Substances Posing a Risk of Cancer" (44 FR 58642) proposed on October 10, 1979, are not final, the proposed standards for EB/S plants have been developed consistent with the proposed EPA policy and procedures. As prescribed in section 112(b)(1)(A) of the Act, the proposal of this standard was preceded by the Administrator's determination that benzene is a hazardous air pollutant as defined in section 112(a)(1) of the Act. Accordingly, the Administrator revised the list of hazardous air pollutants on June 8, 1977, by adding benzene (42 FR 29332).

A Background Information Document has been prepared that contains information on manufacturing and processing ethylbenzene and styrene; the available control technologies for benzene emissions; and analysis of the environmental, energy, economic, and inflationary impacts of regulatory options. Information on the health effects of benzene is contained in documents prepared by or for EPA, entitled the "Assessment of Health Effects of Benzene Germane to Low Level Exposure;" the "Assessment of Human Exposures to Atmospheric Benzene;" and the "Carcinogen Assessment Group's Report on Population Risk to Ambient Benzene Exposures." Supplementary information on the regulation of benzene emissions can be obtained from the Maleic Anhydride Docket No. OAQPS–79–3 which is available for public review at EPA's Central Docket Section. The information contained in these documents is summarized in this preamble. All references used for the information contained in the preamble can be found in these five documents.

Proposed Standard

The proposed standard would limit the amount of benzene discharged to the atmosphere from each process vent stream or combination of process vent streams to five ppmv on a dry basis corrected to three percent oxygen. A process vent stream is defined as any continuous benzene-containing gas stream being released or having the potential of being released to the atmosphere from the alkylation reactor section, atmospheric and pressure columns, hydrogen separation system, or vacuum-producing devices.

The owner or operator of a source which uses a boiler [1] to control benzene emissions would have to monitory oxygen flow, firebox temperature, and compressor flow, and visually inspect process vents to determine if they are being routed to the control device. The owner or operator would have to report to the Administrator within ten days of each occurrence of emissions in excess of the numerical emissions limit (five ppmv) as determined by: (1) A three-hour average oxygen flow level below 1.5 percent by volume, (2) a three-hour average temperature more than 100°F below that measured during the emission test, (3) a three-hour period of no flow from the compressor, or (4) observation of process vent streams not being routed to the control device. The owner or operator of a source which uses a device other than a boiler to control benzene emissions would have to continuously monitor benzene concentrations and compressor flow, and report to the Administrator within

[1] The term "boiler" in this document includes process heaters and super-heaters.

ten days of each occurrence of emissions with concentrations greater than five ppmv or occurrences of no compressor flow.

Emissions in excess of the numerical emission limit (five ppmv) would be allowed during startup and shutdown of the entire source, alkylation reactor section, or dehydrogenation section. Emissions in excess of the numerical emission limit due to process or control equipment failure would be permitted only if the owner or operator of the source demonstrated to the Administrator's satisfaction that these emissions were unavoidable. Emissions in excess of five ppmv that could have been prevented by proper operation and maintenance would be considered avoidable, and therefore would be in violation of the proposed standard which requires that good air pollution control practice be followed. The proposed standard would require that emissions during periods of malfunction, startup, and shutdown be combusted with one or more smokeless flares, or be controlled by an equivalent means approved by the Administrator.

The format of the standard is comprised of two parts. Although continuous process emissions and emissions due to malfunction, startup, and shutdown originate from the same process unit, the control technologies for these emissions as outlined in the regulatory options differ. This is due primarily to flow characteristics and safety considerations inherent in each case.

Unless a waiver of compliance is obtained, each owner or operator would have to be in compliance within 90 days of the promulgation of the standard. A waiver of compliance can be granted by the Administrator for no more than two years from the promulgation date.

Summary of Health, Environmental, Energy, and Economic Impacts

The standard would apply to as many as 13 existing plants that produce ethylbenzene, styrene, or both. A recent analysis of the EB/S industry reveals that no new plants are expected to be constructed within the next five years primarily because the industry is not operating at full capacity.

The proposed standard would reduce total nationwide benzene emissions from all process vents within EB/S plants, based on current control and production at 100 percent capacity, from 2,100 megagrams per year (Mg/yr) to 91 Mg/yr. As a result of this reduction in continous process and excess process emissions, it is estimated that the nationwide incidence of leukemia deaths resulting from exposure to benzene emissions from EB/S process vents within 20 kilometers (km) of EB/S plants would be reduced from a range of 0.03 to 0.2 to a range of 1.3×10^{-4} to 9.2×10^{-4} deaths per year. In addition, a reduction in other health effects associated with benzene exposure (such as cytopenia, aplastic anemia, and chromosomal aberrations) may be expected.

The proposed standard would reduce the estimated maximum lifetime risk due to benzene emissions from EB/S process vents from a range of 6.2×10^{-4} to 4.4×10^{-3} to a range of 1.7×10^{-6} to 1.2×10^{-5}. The maximum lifetime risk represents the probability of someone dying of leukemia who has been exposed for a 70–year period to the highest maximum annual average benzene concentration due to benzene emissions from EB/S process vents.

The proposed standard would achieve the reduction in nationwide benzene emissions with minimal adverse impacts on other aspects of the environment. The other impacts that may occur primarily involve noise and thermal radiation associated with the use of flares for controlling excess emissions during startup, shutdown, or malfunction. Due to recovered energy, compliance with the proposed standard would result in a small energy savings, equivalent to approximately 0.1 percent of the current nationwide EB/S fuel requirements.

The capital investment required per plant to comply with the proposed standard would range from zero to $686,000, based on full capacity. The annualized costs per plant, assuming full capacity, would range from $68,750 to a savings of $140,000. The total nationwide capital cost of the proposed standard would be approximately $3.9 million based on production at 100 percent capacity. The total nationwide annualized cost, assuming full utilization of capacity, would be a net credit of $289,000 per year. The total annualized cost per Mg capacity of styrene would be a net credit of $0.07/Mg. These savings are due to a reduction in process energy requirements as a result of heat recovery from the combusted waste stream in the form of steam. The capital investment required per plant to comply with the proposed monitoring requirements, assuming no existing monitoring equipment, would be a maximum of $16,000 for installing two oxygen and temperature monitors and three flow meters, or $58,000 for installing a gas chromatograph and three flow meters. Finally, no plants are projected to close as a result of implementing the proposed standard.

Background Information on Health Effects of Benzene

The Administrator announced in the June 8, 1977, **Federal Register** (42 FR 29332) his decision to list benzene as a hazardous air pollutant under section 112 of the Clean Air Act. A hazardous pollutant is defined as an "* * * air pollutant to which no ambient air quality standard is applicable and which * * * may reasonably be anticipated to result in an increase in mortality or an increase in serious, irreversible, or incapacitating, reversible illness."

Numerous occupational studies conducted over the past 50 years have shown that health hazards result from prolonged inhalation exposure to benzene. Since 1900 the scientific and medical communities have recognized benzene as a toxic substance capable of causing acute and chronic effects. Benzene attacks the hematopoietic system, especially the bone marrow, and its toxicity is manifested primarily by alterations in the levels of the formed elements in the circulating blood (red cells, white cells, and platelets). The degree of severity ranges from mild and transient episodes to severe and fatal disorders. The mechanism by which benzene causes toxic effects is still unknown.

These adverse effects on the blood-forming tissues, including leukemia, have been documented in studies of workers in a variety of industries and occupations, including the manufacturing or processing of rubber, shoes, rotogravure, paints, chemicals, and, more recently, natural rubber cast film. These studies include single case reports, cross-sectional studies, and retrospective studies of morbidity and mortality among a defined group of workers industrially exposed to benzene.

Based on the entire set of these studies, the Administrator concluded that benzene exposure is causally related to a number of blood disorders, including leukemia (a cancer of the blood-forming system).[2] Although the studies which form the basis of this conclusion involve occupational exposure to benzene at higher levels than those found in the ambient air, the Administrator has "* * * made a generic determination that, in view of the existing state of scientific

[2] Benzene also has been shown to be causally related to various cytopenias (decreaded levels of formed elements in the circulating blood), aplastic anemia (a non-functioning bone marrow), and potentially inheritable chromosomal aberrations.

knowledge, prudent public health policy requires that carcinogens be considered for regulatoy purposes to pose some finite risk of cancer at any exposure level above zero" (44 FR 58646). Because of the widespread use of benzene, benzene emissions in the ambient air have been determined to result in significant human exposure. For these reasons, exposure to benzene emissions may reasonably be anticipated to result in one or more serious effects that can be expected to lead to an increase in mortality or an increase in serious, irreversible, or incapacitating, reversible illness. Therefore, the Administrator concluded that benzene satisfies the definition of a hazardous air pollutant under section 112 of the Clean Air Act.

Rationale for Regulating Ethylbenzene/ Styrene Plants

Stationary source categories of benzene emissions include fugitive emissions form petroleum refineries and chemical manufacturing plants, the gasoline marketing system, process vents at several types of chemical manufacturing plants, coke by-product plants, and benzene storage and handling facilities. Ethylbenzene and styrene production are among the several types of chemical manufacturing plants which emit benzene. Ethylbenzene and styrene are considered jointly for regulation because the plants are located together and frequently physically integrated.

The first step in establishing a standard for benzene was to determine which of the source categories emitting benzene would be regulated. Although a pollutant such as benzene may be considered for regulation under section 112 of the Clean Air Act because emissions from a particular source category post a significant risk, other source categories may also emit the pollutant in lesser amounts. This may occur, for example, because the source categories process very little of the substance, because the substance is present in only trace amounts in the sources' raw materials, or because sources have installed adequate controls on their own initiative or in response to other regulatory requirements.

Approximately 17 percent of the benzene emissions from chemical manufacturing is from EB/S plants; they are the second largest source of benzene emissions in the chemical manufacturing industry. The largest source of benzene emissions in the chemical manufacturing industry is the production of maleic anhydride, which will be regulated under a separate standard.[3] Seventeen plants produce ethylbenzene, styrene, or both. Fifty percent of the benzene produced in the United States for chemical use goes to the production of ethylbenzene, styrene, or both. The current U.S. styrene capacity is 4.0 million Mg/yr (4.4 million tons/yr). The current U.S. ethylbenzene capacity is 4.7 million Mg/yr (5.2 million tons/yr). Benzene emissions from EB/S process vents currently are only controlled an average of 70 percent nationwide. Total benzene emissions from these sources currently are estimated to be about 2,100 Mg/yr.

Approximately 2.5 million people live within 20 km of the 13 EB/S plants that produce ethylbenzene by benzene alkylation and/or styrene by ethylbenzene dehydrogenation or ethylbenzene hydroperoxidation. This is considered the population at risk which is exposed to ambient concentrations of benzene due to benzene emissions from the process vents within these plants. As a result of exposure to these benzene concentrations, it was estimated that the maximum lifetime risk would be within a range of 6.2×10^{-4} to 4.4×10^{-3}. The maximum life time risk is defined here as the probability of an individual (within the assumed exposed population) dying of leukemia who is exposed continuously for 70 years to the highest maximum annual average ambient benzene concentration due to benzene emissions from EB/S process vents. In addition, it was estimated that there would be a range of 0.027 to 0.20 deaths per year within this population due to benzene exposure from EB/S process vents.

While the operating life of the plants (and, in fact, the long-range number of plants) which may be subject to this standard cannot be predicted with certainty, it has been estimated that the typical operating life of an ethylbenzene/styrene plant is 20 years. Individual plants may actually operate much longer than that. Existing plants which have been in operation for some time may have less than 20 years of remaining operating life. However, production of ethylbenzene and styrene began during World War II and there is no indication that production will cease in the foreseeable future. Therefore, it can be expected that if any existing capacity is shut down, it will be replaced by new capacity either at the same or a new plant site. For these reasons, a 20-year operating life expectancy for ethylbenzene/styrene plants would be a reasonable assumption. On this basis, the number of deaths estimated to occur over the life of the 13 existing plants would range from 0.55 to 3.9.

The ranges presented here represent the uncertainty of estimates made concerning the benzene concentrations to which workers were exposed in the occupational studies of Infante, Aksoy, and Ott, which were the basis for developing the benzene unit risk factor (discussed in Appendix E of "Benzene Emissions from the Ethylbenzene/ Styrene Industry," EPA-450/3–79-035a). These ranges are based on a 95 percent confidence interval that assumes the estimated concentrations are within a factor of two.

There are several other uncertainties associated with the estimated number of Leukemia deaths that are not quantified here. The number of deaths were calculated based on an extrapolation of leukemia risk associated with a presumably healthy white male cohort of workers to the general population, which includes men, women, children, non-whites, the aged, and the unhealthy. Uncertainty also occurs in estimating the benzene levels to which people in the vicinity of EB/S plants are exposed. Furthermore, leukemia is the only health effect of benzene considered. Additionally, the benefits to the general population of controlling other hydrocarbon emissions from EB/S production are not quantified. Finally, these estimates do not include the cumulative or synergistic effects of concurrent exposure to benzene and other substances. As a result of these uncertainties, the number of deaths and the maximum lifetime risk calculated around EB/S plants could be overestimated. However, and more importantly, they could just as well be underestimated for the same reasons.

Based on the magnitude of benzene exposures from emissions from this source category, on the resulting estimated maximum individual risks and estimated incidence of fatal cancers in the exposed population for the life of existing sources in the category, and on consideration of the uncertainties associated with these quantitative risk estimates (including the effects of concurrent exposures to other substances and to other benzene emissions), the Administrator finds that benzene emissions from process vents at EB/S plants create a significant risk of cancer and require the establishment of a national emission standard under section 112 of the Clean Air Act.

The Administrator considered a number of alternatives to section 112 of

[3] Proposed rule and notice of public hearing for regulating benzene emissions from maleic anhydride plants was published in the Federal Register on April 18, 1980 (45 FR 26660).

the Clean Air Act for regulating benzene emissions from EB/S plants, including relying instead on the OHSA standard for benzene emissions and hydrocarbon control under State Implementation Plans (SIP's). The current OSHA benzene standard is ten ppm for an eight-hour workday. In 1978, the Secretary of Labor promulgated a more stringent standard that reduced the permissible exposure limit for benzene to one ppm. However, the one ppm standard was held to be invalid by the U.S. Court of Appeals because it was not supported by the administrative record and on July 2, 1980, the U.S. Supreme Court affirmed with the lower Court's ruling. The current OHSA standard stipulates a level of benzene which cannot be exceeded in the workplace. The Administrator does not expect this workplace standard to result in as great a control of benzene emissions from process vents.

Volatile organic compound (VOC) emissions from EB/S plants can be regulated under SIP's designed to meet National Ambient Air Quality Standards (NAAQS) for ozone. However, because SIP's are designed to provide statewide compliance with NAAQS for criteria pollutants, a particular State's strategy for reducing VOC emissions may not require as stringent benzene emission control for EB/S plants as that of another State or as may be appropriate in light of benzene's hazardous nature.

Finally, the Administrator considered using the Toxic Substances Control Act (TSCA) as an alternative, but concluded that the Clean Air Act provides a more direct, expeditious route for regulating benzene emissions from EB/S plants.

Selection of Sources Within Ethylbenzene/Styrene Plants To Be Regulated

The two processes used domestically to produce ethylbenzene are benzene alkylation with ethylene and mixed xylene extraction. The alkylation process represents 95 percent of ethylbenzene production. The two processes for producing styrene are ethylbenzene dehydrogenation and ethylbenzene hydroperoxidation. The hydroperoxidation process is currently used by only one plant and represents ten percent of styrene production.

The proposed standard would apply to the production of ethylbenzene from benzene alkylation and the production of styrene from ethylbenzene dehydrogenation and from ethylbenzene hydroperoxidation. The extraction of ethylbenzene from mixed xylenes is a refinery operation and is not covered because the actual ethylbenzene extraction step has no benzene emissions. Benzene emissions from associated refinery operations are to be regulated under a separate standard controlling benzene emissions from petroleum refinery processes.

The major benzene emission points from EB/S plants and the quantity of benzene each of them emits are summarized below. These emissions are based on a 300,000 Mg/yr model plant and include representative emission points throughout the EB/S industry, although not all plants contain each of these emission points.

Emission points	Benzene emissions kg/hr
Alkylation Reactor Section Vents	11.2
Atmospheric and Pressure Column Vents	45.0
Alkylation and Dehydrogenation Vacuum Column Vents	13.0
Hydrogen Separation Vents	1.0
Hydroperoxidation Vacuum Column Vents	18.7
Ethylbenzene Oxidation Reactor Vents	7.2
Storage	5.3
Fugitive	1.6
Secondary	2.5

The proposed standard would cover process emissions from all the emission points listed above except for the oxidation reactor vent, and fugitive, storage, and secondary emission sources. The sources covered by the standard include essentially all benzene-emitting process vents, except those emitting only traces of benzene (e.g., catalyst preparation area vent). The hydrogen separation vents emission rate reflects the emissions at a controlled rate rather than uncontrolled because, under most conditions, these emissions are controlled. Under uncontrolled conditions the emission rate would be substantially higher. The hydrogen separation vents are covered by the standard because there is one plant which does not control the source and there is a potential for plants to not control the source during routine production.

The oxidation reactor vent contains a relatively small concentration (35 ppmv) of benzene. However, its flow is much larger and much more dilute than the other process vents and consequently would require separate incinerator and a large amount of energy (approximately 3.2×10^8 Megajoules per year (MJ/yr)) to handle the large flow and control the benzene emissions. Because the large amount of energy that would be required to control this vent is grossly disproportionate to the benzene emission reduction (approximately 1.0×10^7 MJ/Mg), the Administrator has concluded that this impact outweighs the benefit from controlling this vent. Therefore, the oxidation reactor vent is not covered by the proposed standard.

Emissions from fugitive, storage, and secondary sources represent approximately ten percent of overall benzene emissions in the EB/S production processes. Separate standards are being developed which will cover fugitive and storage sources of benzene emissions, including EB/S sources. These standards will apply to a large number of similar benzene sources in chemical and other industries and will reduce the number of standards which would cover essentially the same sources.

Selection of Regulatory Options

The Administrator considered four regulatory options to reduce benzene emissions from the continuous process vent streams listed. These regulatory options are based on the control devices currently used in the EB/S industry, namely condensers, absorbers, flares, and boilers; the use of substitutes for styrene also was considered.

Condensation can achieve a varying degree of control for benzene emissions, ranging from 80 to 90 percent control of individual process streams, depending upon the prevailing temperature and pressure of the vent streams and the amount of benzene they contain relative to the other stream components. Two mechanisms exist for condensation: (1) Cooling alone using a condenser, or (2) increasing the system pressure in conjunction with cooling the stream in a condenser. Although a vent stream does not need to be saturated with benzene when using condensation, it should be near saturation before entering the condenser if a high degree of control is desired. Therefore, condensers are applied to gas streams which are continuous and highly concentrated. The gas streams fitting this description vary from plant to plant. Depending on the characteristics of the individual EB/S plant, condensers can be used to control as much as 75 percent of the continuous process emission vents. Five existing EB/S plants use condensers to control benzene emissions. Atmospheric and pressure distillation column vents and the benzene/toluene vacuum column are examples of those vents which are amenable to the use of condensers in some EB/S plants. Condensers, however, cannot handle short-duration, high-volume streams resulting from the intermittent release of the hydrogen separation vent.

Absorption can be used to handle streams dilute with benzene. The degree of control for benzene emissions, ranging from 80 to 99 percent, depends

in part upon the equilibrium between benzene and the absorbing medium at the scrubbing temperature. Packed towers, using chilled polyethylbenzene oils as a benzene absorbent, can be used to control streams of low concentration. The gas streams fitting this description vary from plant to plant. Depending on the characteristics of the individual plant, absorbers can be used to control as much as 75 percent of the continuous process emission vents, such as the reactor vents and the vacuum column vents. One existing EB/S plant uses an absorption system to control benzene emissions.

Boilers can be used to control benzene-containing streams in all EB/S processes. A high control efficiency is achieved by boilers since injecting a vent stream at the burner head results in good fuel/air mixing, and combustion occurs at high temperatures. Based on expected boiler operating conditions and available test data, a 99 percent destruction efficiency is considered achievable for relatively constant gas flows.

Flares also can be used to control benzene emissions by combustion. Approximately 50 percent of all EB/S plants use flares for controlling continuous process emissions. To date, very little documented information exists on the representative destruction efficiency of flares for benzene or any other volatile organic compounds (VOC's). Based on engineering calculations and limited testing on natural gas by a flare vendor, a flare system can be expected to achieve a range of 60 to 99 percent destruction efficiency for VOC's. However, in the past, the Administrator has been reluctant to allow the use of flares as a continuous process emission control device because no practical measuring method exists to detemine if the flares are in compliance. Due to their potentially low or variable efficiency, the Administrator does not consider flares as a single effective control technique for continuous emissions.

Use of a styrene substitute that does not emit benzene during its production is another means of controlling benzene emissions. Although substitutes exist for certain end-uses, no substitute compound has been developed to date with the characteristics appropriate for all styrene.

Although EB/S plants could produce ethylbenzene from mixed xylenes instead of benzene, the Administrator does not consider this substitution as a viable regulatory option. The actual separation of ethylbenzene from mixed xylenes has no benzene emissions. However, as a result of switching ethylbenzene production to extraction from mixed xylenes, benzene emissions from other sources such as associated refinery operations and gasoline distribution may increase with ultimately no reduction in nationwide benzene emissions from all sources.

Combinations of the control devices studied were used in developing the regulatory options for continuous process emissions which the Administrator considered in selecting the basis of the standard. Because there are no technological reasons to consider different or alternative controls for new and existing sources, these regulatory options were considered applicable to both.

Regulatory Option A would involve routing the benzene/toluene column vent and the atmospheric and pressure column vents to condensers to achieve approximately 80 to 90 percent emission reduction and routing the alkylation reactor section vents and other vacuum vents to an absorber to achieve 80 to 99 percent emissions reduction. Based on these controls, this option would give an overall benzene reduction of 85 percent. Regulatory Option B would reduce benzene emissions by 94 percent based on the use of condensers and an absorption tower, which would achieve 85 percent control, combined with a flare with an assumed efficiency of 60 percent. Because of the variability in the destruction efficiency of flares, a 60 percent emissions destruction efficiency is assumed for this analysis as a conservative estimate. Regulatory Option C would reduce benzene emissions by 99 percent based on the use of boilers. This option would involve routing the vacuum column vents, the atmospheric and pressure column vents, the alkylation reactor vents, and the hydrogen separation vent to an existing boiler. Regulatory Option D would involve 100 percent control of benzene emissions based on closure of all ethylbenzene and styrene plants and on the use of substitutes for styrene products.

Existing data indicate that at certain times and under certain conditions process emissions can occur from the process vents previously discussed that could not be controlled practically by any of the regulatory options thus far identified. This is because the flow rate, composition, and pressure characteristics of these process vent streams, which occur under other than normal operation (startup, shutdown, or malfunction of process or control equipment), differ from the continuous process vent streams previously discussed. These emissions, under Regulatory Options A, B, or C, could also exceed the amount of emissions that would be permitted under these options. These "excess" emissions, therefore, would occur whenever the emissions reduction associated with Regulatory Options A, B, or C was not being achieved.

Some of these excess process emissions would be due to sudden and unavoidable process and control equipment failures and are, by definition, malfunctions. Though benzene emissions due to malfunctions can arise anywhere on the production train, certain pieces of equipment have been cited as likely sources of emissions. A hydrogen separation compressor outage is a common type of process or control equipment failure and can, on the average, emit for about ten hours per year approximatly 4,000 kg of benzene (based on a 300,000 Mg/yr model plant).

During normal operation, the compressor directs the stream from the dehydrogenation section to the aromatics recovery unit where the condensables are removed; then the remaining hydrogen-rich stream is routed to the boiler, mixed with natural gas, and is used as supplemental fuel. A primary compressor outage, however, would prevent aromatics recovery and utilization of the stream as fuel and could necessitate venting of the benzene-laden stream to the atmosphere. The primary compressor outage would produce a high-volume, short-duration stream flow.

The condensers and/or absorption towers assumed under Regulatory Options A and B could not be practically applied to controlling this stream since condensation and/or absorption efficiency rates cannot be maintained under these high stream flow conditions.

The boiler, assumed under Regulatory Option C, can attain a high benzene destruction efficiency (99 percent) when process vent stream flow rate and composition are fairly constant. When a primary compressor outage occurs, however, flow rate, pressure, and thermal value of the process vent stream varies significantly. These stream characteristics could risk operational upsets and possible damage to the boiler if the boiler does not have sufficient controls to regulate the fluctuations in stream flow, pressure, and composition. Operational upsets such as firebox temperature excursions would affect the rate of steam generation and thus, the rate of reaction. Temperature fluctuations also damage boiler tubes, thereby causing downtime and safety risks to personnel.

Excess process emissions can also occur during startup and shutdown. A startup involves bringing into full operation equipment in an entire plant, the dehydrogenation section, or alkylation reactor section, which are originally at ambient temperature and empty of process liquids. The procedure requires an average of approximately 12 to 24 hours to fully establish reactions and ensure that the quality of the product meets specifications. In this interim period, however, benzene emissions in excess of the emissions reductions specified under Regulatory Options A, B, or C can be released from certain points in the production train. Based on a 300,000 mg/yr model plant, approximately 4,200 kg or benzene can be emitted for an average of ten hours per year from the entire plant, most of which is from the hydrogen separation vent. Due to a lack of sufficient flow during startup, this stream is not compressed nor is it then sent to the aromatic recovery stream as is the case during normal production. Rather, typical practice involves either venting the stream directly to the atmosphere or flaring it until the dehydrogenation reaction is established fully.

The process vent stream composition during startup varies widely due to entrained nitrogen, reactants, and other process liquids. The condensers and/or absorption towers assumed under Regulatory Options A and B could not be practically applied to controlling this stream because these stream characterisics inhibit efficient absorption and condensation.

During the startup procedure, it is necessary to maintain stable boiler operation while adjusting relative feed rates of reactants and catalyst. Combusting this variable dehydrogenation stream in a boiler, which is the control device assumed under Regulatory Option C, would cause fluctuations in firebox flame temperature and stream saturation rate and would inhibit control of the reactions.

Shutdown involves terminating operation of all equipment in the entire plant, the dehydrogenation section, or alkylation reactor section, and allowing the equipment to cool to ambient temperature. The procedure involves cutting off feedstock to the reactors while concurrently decreasing the introduction of steam, so that the temperature of all equipment reaches ambient levels. During this procedure, benzene emissions in excess of the emissions reductions specified under Regulatory Options A, B, or C can occur. Residual benzene in equipment must be purged before maintenance can begin. During plant shutdown, as in plant startup, the bulk of benzene emissions occur at the hydrogen separation vent. Based on a 300,000 Mg/yr model plant, benzene emissions due to plant shutdown are approximately 4,200 kg/yr from the entire plant.

Variations in stream temperature, composition, flow, and pressure rate occur during the shutdown procedure. This stream cannot be controlled by condensation or absorption equipment due to the wide fluctuations in temperature, composition, flow, and pressure rate. Entrained liquids and nitrogen in the stream would inhibit this control equipment efficiency. During plant shutdown, the boiler firebox temperature and, consequently, steam output is being carefully reduced. This procedure therefore precludes manifolding the waste stream to the boiler.

After this consideration of the application of Regulatory Options A, B, and C to the control of excess emissions during startup, shutdown, and malfunction, the Administrator determined that a separate set of regulatory options should be considered for the excess emissions.

Excess benzene emission from EB/S plants can basically be controlled by combustion and/or backup compressors. Combustion can be accomplished in a boiler or by a flare. An existing boiler can theoretically attain a high benzene destruction efficiency of 99 percent. However, the variable flow, pressure, and composition of excess emissions encountered during periods of startup, shutdown, or malfunction would require major retrofit. Extremely complex controls and monitoring equipment would also be necessary to ensure operational stability and safety.

Smokeless flares are used by approximately 75 percent of existing EB/S plants for controlling excess emissions. Various vent streams can be manifolded to a properly-sized flare for thermal destruction. The main advantage of the flare is its ability to control high-volume, short-duration releases as normally are encountered during equipment malfunction. For example, flares can control emissions due to a hydrogen separation compressor outage, vent gas compressor outage, and streams of highly variable Btu value such as those encountered during startup and shutdown. Smokeless flares can reduce visible emissions to no more than five minutes or less within a two-hour period. A smokeless flare, however, achieves variable levels of control.

Backup compressors can be used to limit emissions resulting from primary compressor failure. A backup compressor can typically come on-line within an hour. This can effectively control 90 to 100 percent of benzene emissions resulting from a primary compressor outage. At present, approximately 50 percent of EB/S plants employ backup compressors. At these plants, however, the backup compressor was installed for conditions specific to those plants.

Based on the above control methods, the Administrator considered four regulatory options for controlling excess emissions during startup, shutdown, and malfunction. Because there are no technological reasons to consider different controls for new and existing sources, these regulatory options apply to both. Regardless of the option selected, avoidable excess emissions due to failures of process or air pollution control equipment caused entirely or in part by deficiencies in design, poor maintenance, careless operation, or other preventable equipment breakdown would be in violation of the proposed standard which requires that good air pollution control practice be followed. Furthermore, failure of process or control equipment, regardless of the cause, would be required to be repaired quickly; failure to do so would constitute avoidable excess emissions and a violation of the proposed standard. Under each of the regulatory options, each occurrence of excess emissions, regardless of the cause, would have to be reported to the Administrator. The Administrator then would judge if the excess emissions were avoidable.

Under Regulatory Option 1, excess emissions would be allowed only during malfunctions, startup, and shutdown. During these times these emissions would have to be combusted by one or more smokeless flares. Under Regulatory Option 2, EB/S owners or operators would have to meet the same requirements as Regulatory Option 1. In addition, they would be required to install backup compressors to control excess emissions during compressor malfunctions and to burn the emissions by one or more smokeless flares until the backup compressor was fully operational. Under Regulatory Option 3, EB/S owners or operators would be required to retrofit existing boilers to accept all excess emissions at all times, allowing these excess emissions to be flared only for short periods required to adjust boiler operation for acceptance of the waste stream at the beginning of an outage. Regulatory Option 4 is the only means of completely eliminating excess

emissions from EB/S plants and would require 100 percent excess benzene emissions reduction based on EB/S plant closure.

Selection of Basis of Standard

The selection of the basis of the proposed standard for benzene emissions from EB/S process vents was a two-step process. The first step consisted of examining the environmental, energy, and economic impacts of various regulatory options and selecting one of them as the best available technology (considering environmental, energy, and economic impacts) (BAT). The second step in the process was to examine the residual health risks remaining after application of BAT to determine whether they were unreasonable in view of the health benefits and costs that would result if a more stringent option were applied. In determining whether the residual risks are unreasonable, and thus whether a level of control more stringent than BAT is to be required, the following factors are compared for the option selected as BAT and the option more stringent than BAT: (1) The range of estimated maximum risk to the most exposed individuals; (2) the range of total estimated cancer incidence and other health effects in the existing and future exposed populations through the anticipated operating life of existing sources; (3) readily identifiable benefits of the substance or activity; (4) the economic impacts of requiring additional control measures; (5) the distribution of the benefits of the activity versus the risks it causes; and (6) other possible health and environmental effects resulting from the increased use of substitutes. The selection of the basis of this standard as described in this section is consistent with these procedures.

In this case, BAT would be selected for EB/S process vents and the health impacts and costs that would result from application of a more stringent option would be examined. As previously discussed, EB/S process vent emissions are comprised of continuous process and excess emissions whose control would require different control techniques. Consequently, this necessitated development of two sets of regulatory options. In order to determine BAT for process vent emissions, the Administrator selected the combination of options for continuous process and excess emissions which he determined represented BAT for process vents. In making his selection, the Administrator examined the impacts of these two sets of options separately and selected BAT for continuous process emissions and BAT for excess emissions. He concluded this combination to be BAT for process vent emissions and then examined the residual risks after application of BAT for process vents.

Although Regulatory Options A, B, and C do not require the use of the specific control device upon which they are based, the control devices were used as a basis for estimating the environmental, energy, and economic impacts of the regulatory options for continuous process emissions on the EB/S industry, using a 300,000 Mg/yr model plant as a representative plant. Regulatory Options 1, 2 and 3 would require specific control devices; these were used in estimating the environmental, energy, and economic impacts of the regulatory options for excess emissions, using the same model plant. Although differences exist between EB/S plants, only one emission point at one plant, the ethylbenzene hydroperoxidation reactor vent, was significant enough to affect the regulatory analysis. Therefore, this analysis was performed using one model plant, with a separate study of the hydroperoxidation reactor vent. To determine nationwide impacts for each regulatory option, the model plant impacts were scaled to each existing plant according to capacity and present level of control. Because new EB/S plants should not differ greatly from existing plants, the 300,000 Mg/yr model plant is considered representative of both. Because Regulatory Option D for continuous process emissions and Regulatory Option 4 for excess emissions assume 100 percent emissions control based on plant closure, only the economic impacts of plant closure were estimated.

Impacts for Continuous Process Emissions

Environmental Impacts. In terms of nationwide air quality impacts, estimated total benzene emissions from continuous process vent streams alone in the EB/S industry are 1,990 Mg/yr, at current control levels and at 100 percent production capacity. Regulatory Options A and B would reduce total continuous process benzene emissions from the industry to 625 Mg/yr and 200 Mg/yr, respectively. Regulatory Option C would reduce total continuous process benzene emissions from the industry to 70 Mg/yr.

Based on dispersion modeling, the highest estimated maximum annual average benzene concentrations which occur within the industry, including emissions from fugitive and storage sources, occur at 160 meters (m) for each option and are 95.6 ppb under existing conditions, 54.1 ppb under Regulatory Option A, 46.1 ppb under Regulatory Option B, and 46.0 ppb under Regulatory Option C. The highest estimated maximum annual average concentrations which occur within the industry due to process vents alone are estimated at 63.6 ppb under existing conditions and 18.2 ppb under Regulatory Option A at a distance of 160 m, 1.4 ppb under Regulatory Option B at a distance of 500 m, and 0.19 ppb under Regulatory Option C at 1,000 m.

None of the regulatory options considered result in any significant increase in wastewater or effluent discharge by EB/S plants nor do they generate any solid waste. Noise and thermal radiation associated with the use of flares, which would be required for reducing benzene emissions from process stream sources if Regulatory Option B were adopted, are negligible.

Energy Impacts. Energy impacts of each regulatory option were also considered. Under Regulatory Option A, energy is required to operate pumps and compressors for the condensers and absorbers. Energy also is required for the cooling system of the condensers. Total energy required for this option is approximately 0.1 percent of the fuel requirements for the model plant. Under Regulatory Option B, flare operation consumes both steam (for smoke control) and natural gas (as a supplemental fuel). In conjunction with the condensers and absorbers, the total energy demand for Regulatory Option B also would approximate 0.1 percent of the fuel requirements for the model plant. Due to heat recovery, Regulatory Option C would result in a small net energy savings, equivalent to approximately 0.1 percent of the fuel requirements for the model plant.

In terms of nationwide energy impacts, Regulatory Options A and B for all existing EB/S plants would require approximately 0.1 percent of the total nationwide EB/S fuel requirements. Due to recovered energy, Regulatory Option C would result in a small total nationwide energy savings, equivalent to approximately 0.1 percent of the current nationwide EB/S fuel requirements.

Economic Impacts. The Administrator considered both capital and annualized costs for Regulatory Options A, B, and C. Nationwide impacts were determined from these cost estimates. Capital and annualized costs for individual pieces of control equipment were based on the equipment requirements of a 300,000 Mg/yr EB/S model plant to achieve a given level of emission reduction. Current control levels and installed equipment at existing plants were accounted for in determining equipment

required at each existing facility to achieve given levels of control.

Regulatory Option A requires the smallest capital outlay of the regulatory options and would range from zero to $268,000 per plant, depending on the current level of control, plant size, and additional equipment needed to meet the control level specified. Regulatory Option B in most cases would require large amounts of piping in addition to pieces of equipment needed in the flare system. Capital costs for this regulatory option would range from zero to $530,000 per plant. Capital costs for Regulatory Option C range from zero to $555,000 per plant, accounting for additional piping and burner retrofit.

Total annualized costs, including operating and maintenance costs, annualized capital costs, and recovered material and fuel credits, would range from $13,500 to a savings of $172,000 per plant under Regulatory Option A; a cost of $45,000 to a savings of $172,000 per plant under Regulatory Option B; and a cost of $26,000 to a savings of $150,000 per plant under Regulatory Option C. The range would be due to differences in the treatment of the various vent streams in each of the plants. Some facilities already control those streams which are close to saturation with benzene and for which treatment results in a net savings. In these cases, the incremental recovery credits are small. Others have a lesser degree of control on these streams. In these cases, the fuel and recovery credits can far exceed the annualized costs of the control device by reducing the amount of supplemental energy and benzene typically required in the process.

In terms of nationwide impact, Regulatory Options A, B, and C each would require 12 plants to install controls. Total nationwide capital costs to the industry would be approximately $1.4 million, $3.1 million, and $3.4 million under Regulatory Options A, B, and C, respectively. No EB/S plants are expected to close as a result of capital costs attributed to controls under Regulatory Options A, B, and C. Based on a review of representative company capital expenditures and financial information, the capital cost of the controls considered are well within the scope of normal spending and the parent companies should have little difficulty with either debt or equity financing.

The industry's total annualized cost, assuming full utilization of capacity and including operating and maintenance costs, annualized capital costs, and fuel and recovered material credits, would be net credits of approximately $608,000 under Regulatory Option A; approximately $202,000 under Regulatory Option B; and approximately $460,000 under Regulatory Option C. Total annualized cost per Mg capacity of styrene would be a net credit of $0.15/Mg under Regulatory Option A; $0.05/Mg under Regulatory Option B; and $0.11/Mg under Regulatory Option C. These savings in Regulatory Options A and B are due to a reduction in benzene requirements as a result of material recovery, and the savings in Regulatory Option C are due to a reduction in process energy requirements as a result of energy recovery from the combusted waste stream in the form of steam. In terms of individual firms, only four companies would experience a total annualized savings under Regulatory Option B, while more than half would realize a savings under Regulatory Options A and C.

Assuming a 15 percent target rate of return, full utilization of capacity and a base price of $463/Mg, styrene unit prices would be expected to increase at a maximum by $0.70/Mg under Regulatory Option A (0.15 percent of product price); $2.14/Mg under Regulatory Option B (0.46 percent of product price); and $1.27/Mg under Regulatory Option C (0.27 percent of product price).[4]

Styrene is used in the manufacture of polystyrene for packaging, food containers, insulation, and furniture; acrylonitrile-butadiene-styrene resins (ABS) for piping and automotive parts; and styrene-butadiene elastomers (SBR) for synthetic rubber, tires, hoses, belting, and adhesives. Any price increase in styrene is expected to be reflected in the price of these goods.

Employment impacts were analyzed for a number of cases. Even under the worst case, the jobs created under Regulatory Options A, B, and C would exceed any employment loss due to any production decrease under those regulatory options. Net employment factors under each regulatory option, except for Regulatory Option D (100 percent control), would probably be positive but small.

Complete prohibition of benzene emissions at ethylbenzene and styrene plants under Regulatory Option D would require closure of ethylbenzene and styrene production because no technology exists which will achieve a zero emission limitation. Banning production of ethylbenzene and styrene would have a negative impact on the producing companies. In 1978, domestic styrene production was valued at $1,135 million; investments in styrene are estimated to be worth approximately $925 million as a high-side estimate; and direct employment in the industry is estimated at 650 to 950 workers. Output, income, and employment impacts would be geographically concentrated to some degree in Texas and Louisiana. A multiplier impact affecting related industries, decreased output, lower overall income, and increased unemployment could be anticipated in these areas.

Regulatory Option D could have a greater negative impact depending upon whether the production of styrene derivatives also must be discontinued. If derivative chemicals are no longer available, specialized fabricators who process such chemicals may face closure. If styrene monomers could be imported in sufficient quantities, styrene derivative production could continue in the United States. The availability of large quantities of styrene monomer for import is questionable. The United States traditionally has been a net exporter of styrene. In 1976, U.S. styrene facilities represented 40 percent of total world capacity. In the near term, it would be unlikely that sufficient imports would be available. In the long term, foreign producers of styrene might choose to further process the monomer themselves and make styrene derivatives available for world consumption.

The magnitude of Regulatory Option D's impact on styrene derivative production could be large. Styrene plastics materials (the intermediate product derivatives) are produced by more than 40 companies throughout the United States. In 1978, production of styrene plastics materials was valued at $1,812 million, and asset values for this industry are estimated to total $1,236 million. Styrene monomer production directly involves less than 1,000 employees, while derivative chemical production may involve more than 10,000 employees.

Banning the production of ethylbenzene and styrene could sharply curtail the availability of many consumer products. Tires in particular would be affected by such a ban because there are no readily available substitutes for SBR from styrene. While natural rubber currently is used in tire manufacturing, there would be insufficient capacity to keep up with demand should styrene not be available.

[4] The maximum price increases are based on the highest price increases required by any one company to cover the cost of meeting the proposed standard. Because the industry is assumed to be operating at 100 percent capacity, the demand for styrene is greater than the supply. Therefore, as the one company raises its prices, other producers can be expected to increase prices similarly to take advantage of the price the market will bear.

As a result, tire prices most likely would rise.

Other natural products such as wood, glass, and paper are available substitutes for plastics, but this type of substitution is limited because of plastic material's technical superiority in some cases. Other man-made products could serve as substitutes for styrene. However, the cost could be too high to be considered justifiable, and if it were justifiable, the prices of the products would increase substantially.

Impacts for Excess Emissions

Environmental Impacts. The estimated total nationwide excess benzene emissions for the EB/S industry are 133 Mg/yr under current controls; 21 Mg/yr under Regulatory Option 1; 10 Mg/yr under Regulatory Option 2; and 1 Mg/yr under Regulatory Option 3. The highest projected maximum annual average benzene concentrations due to uncontrolled excess emissions from within the industry occur at 160 m and are 7.9 ppb. (Uncontrolled conditions means that the current level of controls for excess emissions at existing EB/S facilities, which vary from plant to plant, are not reflected in the calculations.) The highest projected maximum annual average benzene concentrations occur at 2,000 m for each regulatory option and are 4.3×10^{-3} ppb under Regulatory Option 1, 1.4×10^{-3} ppb under Regulatory Option 2, and 2.0×10^{-4} ppb under Regulatory Option 3.

None of the regulatory options considered result in any significant increase in wastewater or effluent discharge by EB/S plants nor do they generate any solid waste. Noise and thermal radiation associated with the use of flares are negligible.

Energy Impacts. Energy requirements for each regulatory option are minimal. Under Regulatory Option 1, a ten-inch smokeless flare is assumed for combusting vent streams generated during startup or shutdown operations and malfunction. Based on average of 12 hours of operation per year for a 300,000 Mg/yr model plant, total steam and natural gas requirements are approximately 5.23×10^6 MJ/yr.

Under Regulatory Option 2, a ten-inch smokeless flare is assumed to be used for combusting vent streams generated during startup or shutdown operations and malfunction. Total energy requirements for steam and natural gas for the model plant is approximately 5.14×10^6 MJ/yr. The backup compressor has no incremental energy impact since only one compressor will be in use at a given time.

Under Regulatory Option 3, all safety valves used in relieving surges in process streams would be manifolded to a smokeless flare, assumed for this case to be ten inches. Total energy requirements for steam and natural gas are approximately 5.1×10^6 MJ/yr for the model plant. Regulatory Option 3 also requires that an existing EB/S boiler be retrofitted to accept vent streams generated as a result of plant startup, shutdown and malfunction. Energy requirements for the boiler are negligible as are credits in terms of steam generated as a result of combusting the waste stream.

In terms of nationwide energy impacts assuming no current excess emissions control, Regulatory Option 1 would require 71×10^6 MJ/yr, Regulatory Option 2 would require 70×10^6 MJ/yr, and Regulatory Option 3 would require 69×10^6 MJ/yr of energy, or approximately 11,200 bbl/yr (fuel oil equivalent) under each option for all existing EB/S plants.

Economic Impacts. Industry-wide capital costs for Regulatory Option 1 would be approximately $524,000 and would require four plants to install excess emission controls. Regulatory Option 2 would require capital outlays of approximately $5.5 million and would require six plants to install controls.[5] Regulatory Option 3 would require the greatest capital outlays, approximately $20 million, and would require 13 plants to install controls. Industry-wide annualized costs for Regulatory Options 1, 2, and 3 would be $171,000, $1.6 million, and $5.2 million, respectively.

Regulatory Option 4 would have the most severe economic impact on the EB/S industry. Because 100 percent excess emission control is technically infeasible, selection of this option would necessitate plant closure. Banning production of ethylbenzene and styrene would have a negative impact on the producing companies and consumers. This impact has been discussed in detail in assessing the economic impact of Regulatory Option D (100 percent process emission control).

Selection of Option for Standard

In selecting the combination of options for the proposed standard, the Administrator first selected BAT for process vents, represented by the combination of BAT for continuous process emissions and BAT for excess emissions. This combination was based on the evaluation of impacts of the two sets of regulatory options developed for controlling these emissions. The Administrator then examined the residual risk after application of BAT for process vents and the health impacts and costs that would result from the application of a more stringent option.

In selecting BAT for continuous process emissions, the Administrator first examined the most stringent option, Regulatory Option D, which would result in closure of EB/S plants. After considering that styrene is a major feedstock used in the production of a number of desirable products such as polystyrene, plastics and rubbers; that styrene substitutes are not readily available in sufficient quantities; that banning ethylbenzene and styrene production would result in a severe economic hardship to the producers of ethylbenzene and styrene and to producers of styrene derivatives, and probably result in price increases to consumers; and that a large number of people would be unemployed, at least temporarily, if these plants were closed; the Administrator concluded that the economic consequences of a standard requiring 100 percent control were too severe to select as BAT. He next examined Regulatory Option C, 99 percent control. After considering that Regulatory Option C would have a net energy savings, no significant adverse environmental impacts, reasonable costs, and no adverse economic impacts, the Administrator selected this regulatory option as BAT for continuous emissions for process vents. It should also be noted that the next less stringent option, Regulatory Option B, would result in higher costs and higher energy consumption than the regulatory option selected as BAT.

In selecting BAT for excess emissions from process vents, the most stringent option, Regulatory Option 4, was examined first. Its economic impacts on EB/S and related industries and its social impact on users of styrene products were determined to be too severe to justify its selection as BAT.

The next less stringent option, Regulatory Option 3, then was examined. The industry-wide capital costs for this option ($20 million) are greater than the costs ($3.4 million) for the regulatory option selected as BAT for continuous process emissions and no recovery credits are involved. Therefore, the industry-wide annualized costs of this regulatory option would be many times higher than the annualized costs for the regulatory option selected as BAT for continuous process emissions. In addition, the emission reduction which would be achieved by this regulatory option (132 Mg/yr) would be

[5] In calculating the capital costs for Regulatory Option 2, it is assumed that of the six plants which require backup compressors, four also require flares. For Regulatory Option 3, it is assumed that of the 13 plants which require boiler retrofits, four also require flares.

very small in comparison to the continuous process emissions reduction achieved by application of 99 percent control (2,030 Mg/yr). For these reasons, the Administrator concluded that the cost impacts of Regulatory Option 3 were too severe for it to be considered as BAT for excess emissions.

The next less stringent option, Regulatory Option 2, then was considered. The industry-wide capital costs for this option ($5.5 million) are also greater than the costs ($3.4 million) for the regulatory option selected as BAT for continuous process emissions. However, no recovery credits are involved. Therefore, the industry-wide annualized cost of this option would be many times higher than the option selected as BAT for continuous process emissions. Furthermore, the emissions reduction which would be achieved by this option (123 Mg/yr) would be very small in comparison to the continuous process emissions reduction achieved by application of 99 percent control (2,030 Mg/yr). Therefore, the Administrator concluded that the cost impacts of Regulatory Option 2 were too severe to be considered as BAT for excess emissions.

Regulatory Option 1 was then examined. This option would require the use of smokeless flares, which most plants already have, to control unavoidable excess emissions. Assuming that plants which currently have flares would use them to meet the proposed standard, only four plants would be required to install smokeless flares if this option were selected as the standard. The total capital costs for these four plants would be only $524,000. The Administrator concluded that these costs were reasonable, and selected Regulatory Option 1 as BAT for excess emissions.

Based on the selection of Regulatory Option C as BAT for continuous process emissions and Regulatory Option 1 as BAT for excess emissions, the Administrator designated this combination as BAT for process vents. He then examined the residual risks remaining after application of BAT for all emissions from process vents at existing EB/S plants to determine whether they are unreasonable in view of the risk reduction which would be gained by requiring a level of control beyond BAT and the cost increase if that level of control were required.

It was estimated that after application of BAT to EB/S process vents there would be a range of 1.3×10^{-4} to 9.2×10^{-4} residual deaths per year within 20 km of existing EB/S plants due to benzene emissions from process vents, and from 0.0026 to 0.018 deaths over the assumed 20-year operating lifetime of the existing plants. In calculating these deaths, it was estimated that 2.5 million people live within 10 km of existing EB/S plants (1970 census data) and it was estimated that EB/S plants are operating at 100 percent of capacity. The maximum lifetime risk to the most exposed population after application of BAT was estimated to range from 1.7×10^{-6} to 1.2×10^{-5} due to continuous process and excess emissions. The maximum lifetime risk represents the probability of a person dying of leukemia who has been exposed for a 70-year period to the highest maximum annual average benzene concentration due to benzene emissions from EB/S process vents.

The next more stringent regulatory option for EB/S process vents would be a combination of Regulatory Option C and Regulatory Option 2. (It is noted that any combination containing Regulatory Option D, industry closure, would not represent the next more stringent option beyond BAT since there are combinations that exist which would attain process vent emission reductions greater than BAT and would not result in closure.) The Administrator then examined the impacts of applying this option. This combination would reduce the number of deaths per year to a range of 9.5×10^{-5} to 6.6×10^{-4}, or 0.0019 to 0.013 deaths over the assumed 20-year operating lifetime of the existing plants. The maximum lifetime risk would be reduced to a range of 1.7×10^{-6} to 1.2×10^{-5}. However, the industry-wide incremental capital costs associated with going from BAT to beyond BAT would increase from $3.9 million to $9.9 million and the industry-wide annualized costs would increase from a net savings of $289,000 to a cost of $1.1 million. In view of the relatively small health benefits that would be gained and the costs of requiring a more stringent option than BAT for process vents, the Administrator concluded the remaining cancer risk from process vents after application of BAT to such vents at existing sources is not unreasonable.

It should be noted that the standard applies only to EB/S process vents and does not cover emissions from fugitive and storage sources. Assuming that the emissions from fugitive and storage sources remain uncontrolled, the reduction in continuous process emissions after the application of BAT would reduce the nationwide incidence due to process, fugitive, and storage emissions from all EB/S plants to a range of 0.017 to 0.11 residual deaths per year. The maximum lifetime risk to the most exposed population after the application of BAT to process emissions would be reduced to a range of 4.1×10^{-4} to 2.9×10^{-3} due to combined emissions from continuous process, fugitive, and storage sources. The selection of BAT for process vents does not preclude future regulation of fugitive and storage emission sources, which are the predominant contributors to the residual risk.

In order to select an option as BAT for new sources and then determine whether a level of control beyond BAT should be required for new sources, it would be necessary to examine the environmental, energy, and economic impacts of requiring the various levels of control represented as Regulatory Options A through D for continuous process emissions and Regulatory Options 1 through 4 for excess emissions for new sources. This would typically be done using the expected growth rate for the industry over the five-year period after the anticipated proposal date of the standard. However, a recent analysis of the EB/S industry revealed that no new facilities are projected to be built within the next five years.

Beyond the five-year period following promulgation of the standard, growth in EB/S production is likely to occur. (It is not projected over the next five years primarily because the industry is not operating at full capacity.) Five years after promulgation, the standard will be reviewed by EPA to examine, among other data, any new information on development in control technology which could be applied to new EB/S sources. In addition, EPA will implement the other new source features of its proposed airborne carcinogen rules after the five-year review if new source construction appears likely at that time.

Selection of Format of Standard

A number of formats for limiting benzene emissions from EB/S process vents were considered. Since the regulatory option selected for the proposed standard for process vents is actually the combination of two separate regulatory options, each controlling different process stream emission characteristics, it is necessary to specify two formats, one for continuous process emissions and one for excess emissions.

The regulatory option selected for controlling continuous process emissions represents a 99 percent emission reduction and is based on the use of a boiler. Because emissions from a boiler can be measured, the Administrator determined that an emission limitation standard for continuous process emissions would be

appropriate, and considered a mass emission standard, a percent reduction standard, and a concentration standard.

Two considerations were important in selecting the appropriate format: (1) Minimizing the number of measurements and calculations required to determine compliance with the standards, and (2) avoiding a standard which would discourage product or fuel recovery from effluent streams containing benzene.

A mass standard based on a mass unit of benzene emitted per mass unit of feed, intermediate product, or final product produced was considered. Although it would allow EB/S plants flexibility in choosing to recover benzene from offgases, it would require consideration of the separate processing stages, which can be run independently of each other at different rates and at different facilities, and would involve determining mass emissions from each source along the production train while tying these measurements with production rate. Consequently, a standard of this format would complicate determining compliance, and also monitoring, because of the large number of measurements required. Therefore, the Administrator considered it inappropriate for EB/S plants.

A percentage reduction standard based on the amount of benzene exiting the control device versus the amount entering the device was considered. This option provides no incentive to reduce the amount of benzene entering the control equipment, and may discourage process changes which recover benzene from effluent streams. Moreover, it may offer a reverse incentive to increase the amount of benzene entering the control device to achieve the desired efficiency level while allowing larger final emission rates, and would involve measuring both incoming and outgoing streams at each point of control. Consequently, this option also was considered inappropriate.

A benzene concentration standard, expressed as ppmv, entails a minimal number of measurements and calculations for both the emissions test and for continuous monitoring. Because it only measures the benzene concentration in the exit stream, it does not discourage benzene recovery. Furthermore, at the inlet concentrations which are found at EB/S plants, the Administrator believes that the control device most likely to be used to meet the standard (boilers) will reduce benzene emissions to a constant benzene concentration. In other words, the exit concentration is not a direct function of the inlet concentration. As the inlet concentration is increased, the reduction efficiency increases with little or no change in the outlet concentration or the mass emissions. Therefore, the Administrator considers a benzene concentration standard to be the most appropriate format based on the considerations discussed above, and selected this format to limit benzene emissions from EB/S plants.

Since the standard for continuous process emissions is based on the use of boilers as the best available control technology, it is necessary to ensure that dilution is not used to meet a benzene concentration level standard. Enforcement of a concentration standard must account for the potential for dilution and, therefore, correction factors are included in the proposed standard to ensure that the benzene concentration measurements from all control devices are similarly referenced and that the quantity of benzene emitted is the same regardless of the amount of excess air used in the boilers. This is done most effectively by referencing all calculations to a dry basis and specific oxygen concentration level in the exhaust gases.

The Administrator has determined that the application of measurement methodology to excess benzene process emissions is not practicable due to technological limitations in the measurement of benzene flare destruction efficiency. Therefore, the Administrator has prescribed the use of a smokeless flare for excess benzene emissions in conjunction with certain work practices and operational standards. Included as part of the proposed standard are requirements that would assure the proper operation and maintenance of any such element of design or equipment.

Selection of Emission Limits

The selection of the numerical emissions limit is based upon the results of two emission tests performed at two EB/S plants. The test at the first plant showed that process heaters receiving benzene-containing vent streams could reduce benzene emissions to between nine and ten ppm referenced to three percent oxygen. However, these results may not reflect the actual benzene levels in the process heater flue gas because various sampling and analytical problems occurred during the test. Therefore, the test results from the first plant are suspect.

The test results from the second plant showed that benzene emissions could be reduced to between zero and 0.5 ppm, with a mean average of 0.39 ppm corrected to three percent oxygen on a dry basis, in a superheater and between zero and 1.4 ppm, with a mean average of 0.5 ppm corrected to three percent oxygen on a dry basis, in a hot oil furnace. These results can be considered representative for the superheater design at the second plant tested because the problems which occurred at the first plant were corrected at the time of the second test and Method 110, the recommended test method, was properly followed. However, because of the design of the superheater at the second plant, the emissions may be lower than those from a more typically designed superheater. The superheater at that plant was receiving approximately 1,500 ppm benzene while other superheaters, on the average, receive up to twice that amount of benzene. Furthermore, due to the burner configuration, benzene passed sequentially through two combustion zones and might have under gone greater destruction than if it has passed through a single combustion zone. The hot oil furnace was receiving approximately 50 to 100 ppm benzene and was reducing these emissions to between zero and 1.4 ppm benzene in the flue gas at three percent oxygen.

Because of the problems experienced during the test at the first plant, the results were not used in calculating the numerical emissions limit. Although the test results from the second plant show that less than two ppm can be achieved, the Administrator is proposing the numerical emission limit at five ppm to provide allowances for varying burner designs and boiler capacities.

Selection of Emission Test Methods

The proposed emission test method for determining benzene emissions is Method 110. Method 110 requires a gas chromatograph with a flame ionization detector for benzene analysis. This test method was used in the emission test at the second plant discussed in the "Selection of the Emission Limits" and was found to be satisfactory in confirming benzene emission levels.

The owner or operator of a source would be required to test emissions within 90 days of the promulgation date for an existing source and within 90 days of startup for a new source, unless a waiver of emission testing is obtained under § 61.13, and to notify the Administrator 30 days in advance of the emission test to afford the Administrator the opportunity to have an observer present during the test.

Each emissions test would consist of three runs, with a time-weighted average of the runs used to determine the emissions. The sampling time for each run would be a minimum of one hour. All calculations of benzene concentration are referenced to a three percent oxygen concentration level in the exhaust gases. Method 3 of 40 CFR

Part 60 shall be used to determine this oxygen concentration. The same sample collected for benzene determination is analyzed for oxygen concentration using an Orsat analyzer. The owner or operator of a source would be required to analyze each sample within 24 hours, to determine the emissions from the test within 30 days of the test, and to notify the Administrator of the results by close of business the following day.

After receipt and consideration of written application, the Administrator may approve alternative emission test methods.

Selection of Monitoring Requirements

In general, monitoring provides an effective and rapid means for enforcement personnel to determine if (1) the control device is operating, (2) the process vent streams covered by the standard are being directed to the control device, and (3) the control device is achieving the emissions limit. If the emissions limit were exceeded, it could be due to control device failure or to intentional altering of the control device.

A gas chromatograph is used to monitor emissions for two other chemical industries regulated under section 112 because it can measure directly the concentration exiting the control device, and therefore can detect if the emissions limit of the standard is exceeded. The gas chromatograph also can detect, by a significant change in the concentration exiting the control device, if large streams are not being routed to the control device, and can determine if the control device is operating.

However, for the purpose of this standard, a gas chromatograph is not the best means of monitoring emissions because the standard is based on the use of a boiler as the control device. This equipment is an integral part of the EB/S process because it produces steam and process heat required for styrene production. Therefore, in this case, the nature of the control device makes monitoring unnecessary to determine if the control dervice is operating. In addition, the EB/S process involves a number of small, individual process vents which are required to be routed to the boiler. Because these vents are so small, a gas chromatograph would not be able to detect if one of these small streams were not being routed through the boiler.

A gas chromatograph could, however, meet the third monitoring objective, i.e., to determine if the control device was achieving the emissions limit, but it would not be necessary. Because the boiler is central to the EB/S process, an incentive exists to operate the device correctly and, in the event of a control device failure, to repair it quickly. Furthermore, even though a gas chromatograph could detect if the numerical emission limit is exceeded during a control device failure, it would provide no data on the cause of the failure. Other monitoring method currently used at EB/S plants could not only detect the failure, but also provide operational data on the boiler to determine the caue of the failure. In addition, these methods would be less expensive and easier to operate than a gas chromatograph.

Examples of these other monitoring methods are the use of indicators and recorders for firebox temperature and flue gas oxygen. During normal operation, these parameters undergo only minor variation. However, during control device failures in which the numerical emission limit would be exceeded, large fluctuations in firebox temperature, flue gas oxygen, or both occur. by detecting these fluctuations, a system monitoring these parameters would determine if the five ppm benzene limit is not being achieved.

Flow meters could be used to determine if the vent streams are being properly routed to the boiler. Such a monitoring sytem typically would require a large number of flow meters, as many as a dozen or more, to monitor all vent stream piping. However, flow meters only at two or three central points in the piping system, such as at compressor outlets, and visual checks of other items, such as valve positions, could be equally effective for monitoring stream flow. This system would be more practical and involve less recordkeeping than a monitoring system based on flow meters on every stream.

A combination of these monitoring methods would provide even greater information concerning the cause of a malfunction than each would individually. For example, if the flow meter detected a disturbance, the oxygen monitor and firebox temperature monitors would also corroborate that a problem existed and could provide data concerning the cause of the malfunction.

Because a combination of these alternate monitoring techniques (1) would effectively meet the monitoring objectives for EB/S plants using boilers as the control device, (2) currently are used within the EB/S industry, and (3) would provide better data on the causes of malfunctions than a gas chromatograph, the Administrator has selected a combination of the alternatives as the proposed monitoring method. The proposed standard would require that owners or operators of sources using boilers as the control device install and continuously operate: (1) A flue gas oxygen monitor with a strip chart recorder, (2) a continuous firebox temperature monitor with a strip chart recorder, and (3) a flow meter which prints a record at least every 30 minutes on each compressor or natural gas ejector. In addition, owners or operators would be required to visually check each process vent stream to determine if each stream covered by the proposed standard is being sent to the boiler. This information would be kept in a weekly log signed by the plant operator.

A 100°F firebox temperature margin below the temperature recorded during the emission test and a 1.5 percent flue gas oxygen level represent clear breakpoints between normal fluctuations in boiler operation and serious failures. Even with normal fluctuations, a correctly operating boiler would be well above these temperature and oxygen limits, while one experiencing a failure would drop significantly below these levels. Therefore, these limits for firebox temperature and oxygen level were selected as parameters which would indicate compliance with the numerical emission limits. However, such a clear breakpoint does not exist for flow meters. Wide fluctuations of flow could be expected under normal operation. Consequently, a flow limit of zero was set to ensure that the flow meter indicates only when a process stream is not being routed to the control device, and not when normal flow fluctuations occur. A three-hour averaging period for these parameters was chosen to be consistent with the averaging period for the numerical emission limit. Finally, the frequency of visual checks was limited to a weekly basis because this would provide sufficient indication that all process vent streams are being routed to the control device without being burdensome to plant personnel. Furthermore, more frequent monitoring, such as daily visual checks, would not necessarily provide any better information about stream flows.

For sources which use air pollution control equipment other than boilers, the Administrator has determined that a gas chromatograph would best meet the monitoring objectives. The proposed standard therefore would require that the owners or operators install and continuously operate a gas chromatograph with a flame ionization detector to monitor the concentration of benzene exiting the control device controlling the process vents. To determine if all the process vent streams are being routed to the control device,

the proposed standard would require owners or operators to install and continuously operate a flow meter that prints a record every 30 minutes on each process vent stream or combination of process vent streams before entry into the control device. They also would be required to make a weekly visual check of each process vent and to keep a weekly log of each. However, because the majority of EB/S plants are expected to use a boiler to combust benzene emissions, this monitoring method is not expected to be used frequently.

The owner or operator of each source would be required to calibrate the required monitoring equipment and certify that the equipment is installed, operated, and maintained according to certain specifications as indicated in the regulation.

The capital investment required per plant to comply with the proposed monitoring requirements would be a maximum of $16,000 for installing two oxygen and temperature monitors and three flow meters, or $58,000 for installing a gas chromatograph and three flow meters. This maximum per plant cost assumes that plants do not have any of the required monitoring equipment. Many EB/S plants, however, currently have some of the required equipment for use in standard process operation. Therefore, the actual per plant cost would vary from plant to plant.

After receipt and consideration of written application, the Administrator may approve alternatives to any monitoring procedures or requirements specified in the proposed standards.

Reporting and Recordkeeping

Owners or operators of sources using boilers as the air pollution control device would be required to submit monitoring and operational data within ten days of any of the following, except during plant startup and shutdown: (1) Oxygen levels below 1.5 percent for a three-hour average, as determined by any flue gas oxygen monitor.

(2) Temperatures 100°F below that registered in the emission test for a three-hour average, as indicated by any firebox temperature monitor.

(3) A flow of zero registered by any flow meter on a compressor or natural gas ejector for a three-hour period.

(4) Two or more weekly visual checks within a 90-day period that determine if any stream is not being routed to the boiler.

Owners or operators of sources using air pollution control equipment other than boilers would be required to report monitoring and operational data within ten days of any of the following, except during plant startup and shutdown: (1) Any release of benzene from process vent streams to the atmosphere in excess of five ppmv benzene for a three-hour average as indicated by a continuous monitoring system.

(2) A flow of zero registered by any flow meter on a process vent stream or combination of process vent streams for a three-hour period.

(3) Two or more weekly visual checks within a 90-day period that determine if any stream is not being routed to the air pollution control device.

The standard would require that each monitoring system be operational before conducting the emissions test required under the proposed standard. All monitoring data, emission test results, and other data needed to determine emissions would be kept and made available to the Administrator for two years following their recording. In addition, owners or operators would be required to notify the Administrator 30 days in advance of plant startup and shutdown. Because the above reporting does not apply during plant startup and shutdown, this notice would identify for the Administrator that period during which the owners or operators would not be subject to the emission monitoring reporting requirements.

The cost to the EB/S industry to keep records and to collect, prepare, and report the data specified by the proposed standard through the first five years would be approximately $122,000.

Public Hearing

A public hearing will be held to discuss the proposed standard for benzene emissions from EB/S plants in accordance with sections 112(b)(1)(B) and 307(d)(5) of the Clean Air Act. Persons wishing to make oral presentations on the proposed standard should contact EPA at the address given in the ADDRESSES section of this preamble. Oral presentations will be limited to 15 minutes each. Any member of the public may file a written statement before, during, or within 30 days after the hearing. Written statements should be addressed to the Central Docket Section address given in the ADDRESSES section of this preamble, and should refer to Docket No. A–79–49.

A verbatim transcript of the hearing and written statements will be available for public inspection and copying during normal working hours at EPA's Central Docket Section in Washington, D.C. (see ADDRESSES section of this preamble).

Docket

This docket is an organized and complete file of all the information submitted or otherwise considered in the development of this proposed rulemaking. This principal purposes of the docket are (1) to allow interested parties to readily identify and locate documents so they can intelligently and effectively participate in the rulemaking process, and (2) to serve as the record in case of judicial review.

Miscellaneous

In accordance with section 117 of the Act, appropriate advisory committees, independent experts, and Federal departments and agencies were consulted before this proposal was published. In addition, members of the benzene task group of the Interagency Regulatory Liaison Group, representing EPA, OSHA, the Food and Drug Administration, and the Consumer Product Safety Commission, have met and reviewed the proposed regulation to ensure that the statement of the rule is jointly understood and is consistent with their programs. The Administrator welcomes comments on all aspects of the proposed regulation, including economic and technological issues.

This regulation will be reviewed five years from the date of promulgation. This review will include an assessment of such factors as the need for integration with other programs, the existence of alternative methods, enforceability, and improvements in emission control technology, and reporting requirements. The reporting requirements in this regulation will be reviewed as required under the EPA sunset policy for reporting requirements in regulations.

Dated: December 12, 1980.

Douglas M. Costle,

Administrator.

It is proposed that Part 61 of Chapter I, Title 40 of the *Code of Federal Regulations* be amended by adding a new Subpart as follows:

Subpart I—National Emission Standard for Benzene Emissions From Ethylbenzene/Styrene Plants

Sec.

61.100 Applicability and designation of source.
61.101 Definitions.
61.102 Emission standard and compliance provisions.
61.103 Excess emissions reports.
61.104 Emission test and procedures.
61.105 Emission monitoring.
61.106 Recordkeeping.

Authority: Sec. 112, 114, 301(a) of the Clean Air Act as amended (42 U.S.C. 7413, 7414, 7601(a)), and additional authority as noted below.

Subpart I—National Emission Standard for Benezene Emissions From Ethylbenzene/Styrene Plants

§ 61.100 Applicability and designation of source.

This subpart applies to each integrated chemical process producing either ethylbenzene from benzene or styrene from ethylbenzene, and containing one or more of the following equipment: (a) Alkylation reactor section, (b) ethylbenzene hydroperoxidation reactor, or (c) hydrogen separation system.

§ 61.101 Definitions.

The terms used in this subpart are defined in the Clean Air Act, in § 61.02, or in this section as follows:

"Alkylation reactor section" means any equipment or combination of equipment in which benzene is reacted with ethylene to produce ethylbenzene, in which the reactor catalyst is neutralized or separated from reaction products and impurities, or in which diethylbenzene and polyethylbenzene are catalytically transformed to ethylbenzene and by-products.

"Atmospheric column" means each distillation column which operates at atmospheric pressure.

"Continuous monitoring system" means the total equipment used to sample, to analyze, and to provide a permanent record of emissions or process parameters.

"Dehydrogenation reactor" means a reactor in which ethylbenzene is catalytically dehydrogenated in the presence of steam to produce styrene and by-products.

"Distillation column" means a vessel in which a vapor is produced by heating a liquid, with subsequent collection and condensation of the vapors into liquids for the purpose of concentration or purification.

"Ethylbenzene hydroperoxidation reactor" means any equipment or combination of equipment in which ethylbenzene is oxidized with air or oxygen to produce ethylbenzene hydroperoxide.

"Hydrogen separation system" means the combination of equipment in which the crude styrene, unreacted ethylbenzene, and condensed steam is separated from the hydrogen-rich gas stream exiting the ethylbenzene dehydrogenation reactor.

"Malfunction" means any sudden and unavoidable failure of process or air pollution control equipment. A failure of process or air pollution control equipment caused entirely or in part by design deficiencies, poor maintenance, careless operation, or other preventable equipment breakdown shall not be considered a malfunction.

"Natural gas ejector" means a device using a nozzel and a natural gas or nitrogen-driving fluid to increase process vent stream pressure.

"Pressure column" means each distillation column which operates at greater than atmospheric pressure.

"Process vent stream" means any benzene containing continuous gas stream being released or having the potential of being released to the atmophere from each of the following equipment: (1) Alkylation reactor section; (2) atmospheric or pressure column; (3) hydrogen separation system; (4) vacuum-producing device.

"Shutdown" means the cessation of operation to ambient temperature of the (1) entire source as designated in §61.100; (2) alkylation reactor section; or (3) dehydrogenation reactor.

"Smokeless flare" means a flare which produces visible emissions for no more than five minutes within any two-hours period.

"Startup" means the commencing in operation from ambient temperature of the (1) entire source as designated in § 61.100; (2) alkylation reactor section; or (3) dehydrogenation reactor.

"Vacuum-producing device" means each devise which produces an absolute pressure less than atmospheric on any distillation column.

§ 61.102 Emissions standard and compliance provisions.

(a) No owner or operator subject to the provisions of this subpart shall discharge into the atmosphere from a source a process vent stream or combination of process vent streams containing in excess of five parts per million by volume (ppmv) of benzene on a dry basis corrected to three percent oxygen over a time-weight average of three hours.

(b) The emission limit specified in paragraph (a) of this section shall not apply during—(1) malfunctions; (2) startup; or (3) shutdown. During startup, shutdown, and malfunctions, the owner or operator of each source shall combust all emissions by one or more smokeless flares.

(c) The owner or operator of each source shall maintain and operate the source, including associated air pollution control equipment, in a manner consistent with good air pollution control practice for minimizing benzene emissions. A determination whether acceptable operating and maintenance procedures are being use will be based on information supplied to the Administrator, which may include but is not limited to monitoring results, review of operating and maintenance procedures, inspection of the source, and review of records.

(d) Upon written application from an owner or operator, the Administrator may approve use of equipment or procedures which have been demonstrated to his satisfaction to be equivalent in terms of reducing benzene emissions during startup, shutdown, or malfunction. Owners or operators requesting approval by the Administrator for use of equivalent means for reducing excess emissions shall submit, along with their request, data or calculations supporting their contention that the alternate means would reduce the emissions by an equivalent amount.

§ 61.103 Excess emissions reports.

(a) The owners or operators of each source must comply with the reporting requirements specified in paragraphs (b) and (c) of this section after the emission test required under § 61.104(a).

(b) The owner or operator shall notify the Administrator in writing 30 days in advance of each anticipated startup and shutdown and shall provide an estimate of the anticipated duration of each startup and shutdown.

(c) The owner or operator shall report to the Administrator each occurrence of excess emissions as defined in paragraphs (c) (1) and (2) of this section except for those during startup or shutdown, within ten days of each occurrence.

(1) For sources using a boiler or process heater as the air pollution control device, excess emissions means any occurrence of emissions exceeding the emissions limit specified in § 61.102(a), as indicated by any of the following: (i) Oxygen flow levels, as determined by any flue gas oxygen monitor, below 1.5 percent for a three-hour average.

(ii) Temperatures, as indicated by any firebox temperature monitor, more than 100°F below that registered in the emission test for a three-hour average.

(iii) A flow of zero registered by any flow meter on a compressor or natural gas ejector for a three-hour period.

(iv) Two or more weekly visual checks within a 90-day period that determine if any process vent stream is not being routed to the boiler.

(2) For sources using air pollution control devices other than a boiler or process heater, excess emissions means any occurrence of emissions exceeding the emissions limit specified in § 61.102(a), as indicated by the following: (i) A continuous monitoring system using a gas chromatograph with

a flame ionization detector for a three-hour average.

(ii) A flow of zero registered by any flow meter on a process vent stream or combination of process vent streams for a three-hour period.

(iii) Two or more weekly visual checks within a 90-day period that determine if any process vent stream is not being routed to the control device.

(d) The owner or operator shall submit the following information as a minimum in the report required under paragraph (c) of this section: (1) The identity of the process vent streams where the excess emissions occurred.

(2) Continuous monitoring and operational data which indicated the excess emissions.

(3) The cause, description, and duration of the excess emissions.

(4) A statement whether or not the owner or operator of the source believes that a malfunction has occurred.

(e) If the owner or operator of a source states that a malfunction has occurred, he or she also shall submit the following information as a minimum in the report required under paragraph (c) of ths section: (1) The steps taken to remedy the malfunction and the steps taken or planned to prevent a recurrence of the malfunction.

(2) Documentation that the air pollution control equipment, process equipment, or processes were at all times maintained and operated, to the maximum extent practicable, in a manner consistent with good practice for minimizing emissions and were designed in accordance with good engineering practices.

(f) The owner or operator of each source shall submit reports by certified mail to the Administrator and shall indicate that the reports are being submitted in accordance with § 61.103.

§ 61.104 Emission test and procedures.

(a) Unless a waiver of emission testing is obtained under § 61.13, the owner or operator shall test emissions from each process vent stream discharged to the atmosphere from the source—

(1) Within 90 days of the effective date in the case of an existing source or a new source which has an initial startup date preceding the effective date; or

(2) Within 90 days of startup in the case of a new source, initial startup of which occurs after the effective date.

(b) The owner or operator shall provide the Administrator 30 days prior notice of the emission test to afford the Administrator the opportunity to have an observer present.

(c) Each emission test must be conducted while the equipment being tested is operating at the maximum rate at which the equipment will be operated.

(d) Each sample must be analyzed within 24 hours of sample collection. Emissions must be determined within 30 days after the emission test. The owner or operator shall report the determinations to the Administrator by a registered letter dispatched before the close of the next business day following the determination.

(e) The owner or operator of each source shall use the following test methods to determine compliance with the numerical emission limit prescribed in § 61.102 unless the Administrator has approved an application requesting the use of an alternative or equivalent method. If the Administrator finds reasonable grounds to dispute the results obtained by an equivalent or alternative method, he may require the use of a reference method. If the results of the reference and equivalent or alternative methods do not agree, the results obtained by the reference method prevail, and the Administrator may notify the owner or operator that approval of the method previously considered to be equivalent or alternative is withdrawn.

(1) Method 3 of Appendix A, Title 40 CFR Part 60 for air dilution correction, based on three percent oxygen in the emission sample.

(2) Method 110 of Appendix B, Title 40 CFR Part 61 for benzene analysis.

(f) Each emission test must consist of three runs. One sample containing a minimum volume of 50 liters corrected to standard condition must be collected for each run. For the purpose of determining emissions, the average of the results from all three runs is to apply. The average must be computed on a time-weight basis.

(g) The sampling time for each run must be a minimum of one hour.

(h) The sampling site must be at least two stack or duct diameters downstream and one-half diameter upstream from any flow disturbance such as a bend, expansion, contraction, or visible flame. The sampling point in the duct must be at the centroid of the cross section. The sample must be extracted at a rate proportional to the gas velocity at the sampling point. For a rectangular cross section an equivalent diameter must be determined from the following equation:

$$\text{equivalent diameter} = \frac{2(\text{length})(\text{width})}{\text{length} + \text{width}}$$

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414))

§ 61.105 Emissions monitoring.

(a) The owner or operator of each source using a boiler or process heater as the air pollution control device shall install and continuously operate the following equipment: (1) In the exhaust flue of each boiler or process heater receiving a process vent stream, a flue gas oxygen monitor with a strip chart recorder.

(2) Prior to any convective heat transfer surfaces in the firebox, a continuous firebox temperature monitor with a strip chart recorder.

(3) At each compressor and at each suction point of each natural gas ejector handling a process vent stream, a flow meter with a strip chart recorder.

(b) The owner or operator of each source, except those specified in paragraph (a) of this section shall install and continuously operate—

(1) A continuous monitor system with a flame ionization detector which monitors the concentration of benzene emissions discharged to the atmosphere from each process vent stream or combination of process vent streams; and

(2) At each compressor and at each suction point of each natural gas ejector handling a process vent stream, a flow meter with a strip chart recorder.

(c) For the monitoring equipment specified in paragraphs (a) and (b) of this section, the following specifications shall apply: (1) Each flue gas oxygen monitor shall—

(i) Be accurate to ±5 percent of the normal operating range;

(ii) Be calibrated weekly using either air, or a prepared cylinder oxygen standard that is analyzed and certified by the manufacturer to be accurate within ±2 percent, and that has a maximum shelf life recommended by the manufacturer for each cylinder so that the concentration does not change more than ±5 percent from the certified value; and

(iii) Have a sampling location at least two stack or duct diameters downstream and one-half stack or duct diameters upstream from any flow disturbance. For a rectangular cross section, the equivalent diameter shall be determined by:

$$\text{equivalent diameter} = \frac{2(\text{length})(\text{width})}{(\text{length}) + (\text{width})}$$

The sampling point in the stack or duct shall be at the centroid of the cross section.

(2) Each firebox temperature monitor shall be installed, operated, calibrated, and maintained according to the manufacturer's specifications and shall have an accuracy of ±2 percent over the normal operating range.

(3) Each flow meter shall be installed, operated, calibrated, and maintained according to the manufacturer's specifications and shall have an accuracy of ±5 percent over the normal operating range.

(4) Each continuous monitoring system shall—

(i) Be a device that obtains process vent stream samples from one or more emission points on a continuous, sequential basis and analyzes the samples for benzene with gas chromatography or, if the organics measured are benzene only, with infrared spectrophotometry, and a flame ionization detector;

(ii) Complete a minimum of one cycle of operation (sampling, analyzing, and data recording) at each source in each successive one-hour period;

(iii) Be verified for operational status by completing the manufacturer's written requirements or recommendations for checking the operation or calibration of the device; and

(iv) Be calibrated by using a standard benzene mixture equal to five ppmv, prepared using the procedures given in section 7 of Method 110, or by using cylinder standards conforming to the requirements of paragraph 5.2.3 of Method 110. A daily zero check shall be performed for each continuous monitoring system using a zero gas with benzene concentration less than 0.1 ppm by volume.

(d) The owner or operator of each source shall visually check each process vent stream weekly to determine if each stream is being sent to the air pollution control device and keep a log, signed by the owner or operator, of each observation.

(e) The owner or operator of each source shall install and operate all monitoring equipment before conducting the emission test under § 61.104.

(f) During any emission tests required under § 61.104 or at such other times required by the Administrator under section 114 of the Act, the owner or operator of each source shall furnish the Administrator a written report of the measurements made by the continuous monitoring system during the emission test within 60 days of the test.

(g) After receipt and consideration of written application, the Administrator may approve alternatives to any monitoring procedures or requirements of this part.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414))

§ 61.106 Recordkeeping.

(a) The owner or operator of each source which uses a boiler or process heater as the air pollution control device shall keep records of the following information: (1) All oxygen level measurements from each flue gas oxygen monitor.

(2) All temperature measurements from each firebox temperature monitor.

(3) All flow rate measurements from each compressor or natural gas ejector flow meter.

(4) All visual checks for each process vent stream.

(5) All emission test results and other data needed to determine emissions as specified in § 61.104.

(b) The owner or operator of each source, except those specified in paragraph (a), shall keep records of the following information: (1) All benzene concentration measurements of the exhaust gas by the monitor specified in § 61.105(b)(1).

(2) The procedures used for converting the measured benzene concentrations to a dry basis, and data that demonstrates that such procedures produce accurate results.

(3) All flow rate measurements from each compressor or natural gas ejector flow meter.

(4) All visual checks for each process vent stream.

(5) All emission test results and other data needed to determine emissions as specified in § 61.104.

(c) Each owner or operator shall keep the records specified in paragraphs (a) and (b) of this section at the source and make them available for inspection by the Administrator for a minimum of two years.

(Sec. 114 of the Clean Air Act as amended (42 U.S.C. 7414))

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AGENCY PUBLICATION ON ASSIGNED DAYS OF THE WEEK

The following agencies have agreed to publish all documents on two assigned days of the week (Monday/Thursday or Tuesday/Friday). This is a voluntary program. (See OFR NOTICE 41 FR 32914, August 6, 1976.)

Monday	Tuesday	Wednesday	Thursday	Friday
DOT/SECRETARY	USDA/ASCS		DOT/SECRETARY	USDA/ASCS
DOT/COAST GUARD	USDA/FNS		DOT/COAST GUARD	USDA/FNS
DOT/FAA	USDA/FSQS		DOT/FAA	USDA/FSQS
DOT/FHWA	USDA/REA		DOT/FHWA	USDA/REA
DOT/FRA	MSPB/OPM		DOT/FRA	MSPB/OPM
DOT/NHTSA	LABOR		DOT/NHTSA	LABOR
DOT/RSPA	HHS/FDA		DOT/RSPA	HHS/FDA
DOT/SLSDC			DOT/SLSDC	
DOT/UMTA			DOT/UMTA	
CSA			CSA	

Documents normally scheduled for publication on a day that will be a Federal holiday will be published the next work day following the holiday.
Comments on this program are still invited.
Comments should be submitted to the Day-of-the-Week Program Coordinator, Office of the Federal Register, National Archives and Records Service, General Services Administration, Washington, D.C. 20408

NOTE: As of September 2, 1980, documents from the Animal and Plant Health Inspection Service, Department of Agriculture, will no longer be assigned to the Tuesday/Friday publication schedule.

REMINDERS

The "reminders" below identify documents that appeared in issues of the **Federal Register** 15 days or more ago. Inclusion or exclusion from this list has no legal significance.

Rules Going Into Effect Today

Note: There were no items eligible for inclusion in the list of Rules Going Into Effect Today.

List of Public Laws

Last Listing December 17, 1980

This is a continuing listing of public bills from the current session of Congress which have become Federal laws. The text of laws is not published in the **Federal Register** but may be ordered in individual pamphlet form (referred to as "slip laws") from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (telephone 202–275–3030).

H.J. Res. 205 / Pub. L. 96–529 Authorizing appropriation of funds for acquisition of a monument to Doctor Ralph J. Bunche and installation of such monument in Ralph J. Bunche Park in New York City (Dec. 15, 1980; 94 Stat. 3119) Price $1.

H.R. 8061 / Pub. L. 96–530 District of Columbia Appropriation Act (Dec. 15, 1980; 94 Stat. 3121) Price $1.

H.R. 6243 / Pub. L. 96–531 To provide that the park referred to as the East Lake Park located within the West Point Lake project on the Chattahoochee River, Georgia, shall hereafter be known and designated as the "R. Shaefer Heard Park" (Dec. 15, 1980; 94 Stat. 3129) Price $1.

S. 2134 / Pub. L. 96–532 To provide for the acquisition of certain property in square 758 in the District of Columbia as an addition to the grounds of the United States Supreme Court Building (Dec. 15, 1980; 94 Stat. 3130) Price $1.

H.R. 6942 / Pub. L. 96–533 International Security and Development Cooperation Act of 1980 (Dec. 16, 1980; 94 Stat. 3131) Price $2.

S. 1835 / Pub. L. 96–534 To extend the Joint Funding Simplification Act of 1974 (Dec. 16, 1980; 94 Stat. 3164) Price $1.

H.R. 5856 / Pub. L. 96–535 To amend title 32, United States Code, to allow Federal recognition as officers of the National Guard of members of the National Guard of the Virgin Islands in grades above the grade of colonel (Dec. 16, 1980; 94 Stat. 3165) Price $1.

THE FEDERAL REGISTER: WHAT IT IS AND HOW TO USE IT

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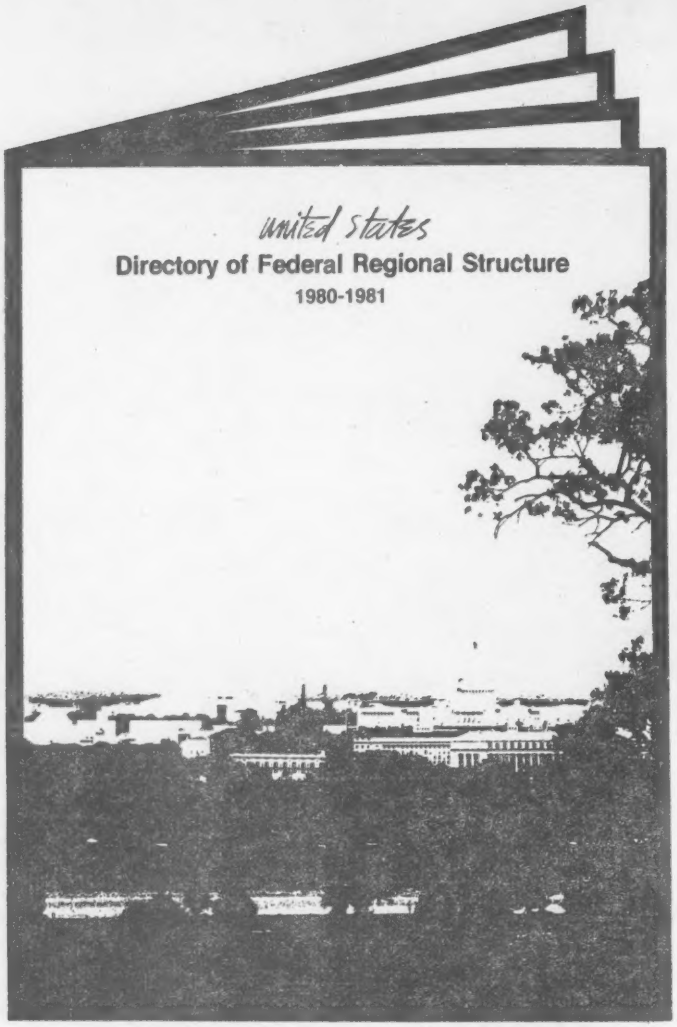
WHY: To provide the public with access to information necessary to research Federal agency regulations which directly affect them, as part of the General Services Administration's efforts to encourage public participation in Government actions. There will be no discussion of specific agency regulations.

WHEN: January 16 and 30; February 13 and 27; at 9 a.m. (identical sessions).

WHERE: Office of the Federal Register, Room 9409, 1100 L Street NW., Washington, D.C.

RESERVATIONS: Call King Banks, Workshop Coordinator, 202–523–5235.



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